

# NASA TECH BRIEF



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## Electronic Sleep Analyzer

An electronic analyzer instrument (schematic overleaf) has been designed and constructed in prototype form to automatically monitor the stages of sleep of a human subject. The analyzer provides a series of discrete voltage steps with each step corresponding to a clinical assessment of level of consciousness: awake, drowsy, light sleep, deep sleep, and abnormally slow (e.g., coma). The sleep level is also indicated by the illumination of one of six panel lamps. The instrument is based on the operation of an EEG (electroencephalogram), as the latter is generally recognized to be the most dependable indicator of the occurrence of sleep and of the various stages of sleep. The new instrument has been designed for possible use in manned spaceflight monitoring and would therefore have to be independent of human experts for proper interpretation of the data over extended time periods. In addition, for such use, it must operate over a limited telemetry bandwidth to allow continuous transmission of conventional EEG activity. This analyzer differs from previous sleep analyzers in that it includes all of the following features: (1) packageable in small size (for use on a spacecraft); (2) requires very little telemetry bandwidth or time; (3) designed specifically for the determination of state of sleep, (4) operational in real time, (5) requires only one channel of EEG activity (central to occipital); and (6) not excessively biased by occasional electrode or movement artifacts.

The instrument uses selected aspects of the total available EEG signal to continuously assess the sub-

ject's state of consciousness or sleep; this assessment is expressed as a dc output voltage proportional to sleep stage. It considers approximately 15 sec of EEG before making a decision concerning the level of sleep, and therefore the output changes very slowly. Thus, the desired information can be telemetered using as few as 3 samples per minute (each sample could be a 3-bit number proportional to the output voltage of the analyzer). This method is comparable to that of human interpretation, in which a block of EEG signals several seconds in duration is ordinarily considered as a whole, rather than in a wave-by-wave analysis.

### Note:

Requests for further information may be directed to:  
Technology Utilization Officer  
Manned Spacecraft Center, Code BM7  
Houston, Texas 77058  
Reference: TSP70-10110

### Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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(continued overleaf)

